

REMARKS

Applicant acknowledges the Examiner's indication of allowable subject matter in claims 2 and 9. However, Applicant has not rewritten these claims in independent form to include all of the limitations of the base claim and any intervening claims because at least generic claim 1 and 8 are distinguishable over the cited prior art.

In the outstanding Office Action, the Examiner: objected to the drawings; rejected claims 3, 4, 6, 7, 8, 10, 11, 13, and 14 under 35 U.S.C. § 112, ¶2, as being indefinite; and rejected claims 1, 3-8, and 10-14 under 35 U.S.C. § 103(a) as being unpatentable over Matsumoto (JP 11-121196) in view of Suzuki et al. (EP 0880164).

Claims 1-20 are pending in this application, with claims 1, 8, and 15 being independent claims. Claims 1, 3, 4, 6-8, 10, 11, 13, and 14 are amended to more clearly define features of the present invention. Claims 15-20 are newly added. No new matter has been entered.

Applicant respectfully requests reconsideration and withdrawal of the objection and rejections set forth in the above-identified Office Action.

OBJECTIONS TO DRAWINGS

The Examiner objected to the drawings under 37 C.F.R. § 1.83(a). The Examiner asserts that the conductor and the microwave absorber must be shown or the features canceled from the claims. Applicant respectfully submits that, though not specifically designated with reference characters, the microwave absorbers and the conductors disposed in the terminal end portions of the connecting waveguide and the antenna waveguides are adequately illustrated in the drawings, together with the

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1300 I Street, NW
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specification, in such a manner that one of ordinary skill in the art would recognize where and in what manner a conductor or a microwave absorber is being utilized.

Nevertheless, Applicant has amended the drawings and the specification to include reference characters "24a," "28a," and "28b," designating microwave absorbers disposed in the terminal end portion of the connecting waveguide and the terminal end portions of the antenna waveguides. Thus, reconsideration and withdrawal of this objection is respectfully requested.

The Examiner objected to Fig. 5 because the figure should be designated by a legend such as --Prior Art--. As suggested by the Examiner, Applicant has amended Fig. 5 to include a legend --Prior Art--. Thus, reconsideration and withdrawal of this objection is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 112, ¶2

The Examiner rejected claims 3, 4, 6, 7, 8, 10, 11, 13, and 14 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner asserted that the difference between the conductor and microwave absorber and the appearance of the conductor and microwave absorber are unclear. Applicant respectfully traverses this rejection.

Applicant respectfully submits that a microwave absorber or conductor is well-known in the microwave art and one skilled in the art would easily recognize the difference between them. For example, a microwave absorber is to absorb microwaves to prevent formation of non-propagating standing waves, where a conductor is to reflect the microwaves to form the standing waves.

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In response to the Examiner's assertion regarding the appearance of the conductor and the microwave absorber, Applicant respectfully submits that the appearance is irrelevant to the patentability of the present invention and does not render the present claims indefinite, since the scope of the invention sought to be patented can be determined from the language of the claims without any need for claiming a particular appearance.

Regarding insufficient antecedent basis for "said microwaves" in claim 8, Applicant has amended claim 8 to obviate this rejection.

Applicant respectfully submits that claims 1-20 fully satisfy the requirements of 35 U.S.C. § 112, ¶2. Thus, reconsideration and withdrawal of these rejections is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 103(a)

Claims 1, 3-8, and 10-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Matsumoto (JP 11-121196) in view of Suzuki et al. (EP 0880164). Applicant respectfully traverses this rejection.

Each of the claims is drawn to a different combination of structural components that is patentable over the teachings of the cited prior art. In particular, independent claim 1 recites a combination including, among other things, an antenna having a plurality of substantially ring-shaped antenna waveguides substantially concentrically arranged, each of the antenna waveguides comprising a proximal end portion, a terminal end portion, and a connecting waveguide connected to the proximal end portion of each of the antenna waveguides. Independent claim 8 includes similar recitations.

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While admitting the deficiency (e.g., the absence of any disclosure of a plurality of substantially ring-shaped antenna waveguides) in Matsumoto et al., the Examiner asserts that the disclosure of Suzuki et al. makes up for the deficiency of Matsumoto et al. The Examiner argues that “[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to provide the apparatus of Matsumoto with a plurality of a ring-shaped antenna waveguides as taught by Suzuki” and that “this would allow microwaves to radiate over a large area and for a relatively uniform intensity distribution.”

Applicant respectfully submits that the Examiner’s assertions as to the cited prior art do not establish a proper *prima facie* case of obviousness under 35 U.S.C. § 103(a). It appears that the Examiner has improperly pieced various aspects of the present invention from the prior art together with a good deal of hindsight and with the invention as a road map to make an obviousness rejection.

“The examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability.” *In re Oetiker*, 24 USPQ 2d 1443, 1444 (Fed. Cir. 1992) (Emphasis original). Thus, the Examiner must follow the criteria necessary to establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art references when combined must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Finally, there must be a reasonable expectation of success. M.P.E.P. § 2143.

Furthermore, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicants' disclosure. See *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Additionally, the evidence of a teaching, suggestion, or motivation to combine must be "clear and particular." *In re Dembiczak*, 175 F.3d 994, 999 (Fed. Cir. 1999). As will be described below, combination of the cited references fails to establish a *prima facie* case of obviousness under 35 U.S.C. § S.C. § 103(a).

Matsumoto et al. discloses a microwave plasma process apparatus having an antenna (11) with a tubular member curved in a C shape or a spiral shape. The antenna (11) includes a waveguide antenna part (12), and one end of the waveguide antenna part (12) is coupled with a waveguide (21) connected with a microwave oscillator (20) while the other end is closed.

Suzuki et al. discloses a plasma processing apparatus with microwave applicator (3) having a plurality of annular waveguides (43, 44). Each waveguide (43, 44) is annular and has no terminal planes. The microwaves introduced into the annular waveguides (43, 44) are each distributed in the opposite directions by the distributors (10) and propagate through the waveguides clockwise and counterclockwise to generate standing waves.

As to the first criterion for a proper *prima facie* case of obviousness, the combination of Matsumoto et al. and Suzuki et al. does not teach or suggest all the claimed elements. The Examiner argues that "it is known for a microwave applicator 3 (antenna) to have a plurality of annular waveguides." Even if this argument were correct, the combination of the cited prior art still fails to teach each of the antenna

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waveguides comprising a proximal end portion, a terminal end portion, and a connecting waveguide connected to the proximal end portion of each of the antenna waveguides.

While the Examiner fails to clearly set forth how and in what manner the teaching of Suzuki et al. are incorporated in the apparatus of Matsumoto et al., it appears that the Examiner attempts to combine the plurality of annular waveguides of Suzuki et al. with the apparatus of Matsumoto et al. However, the Examiner's alleged combination fails to suggest that each of the antenna waveguides has proximal and terminal end portions, as claimed. The annular waveguides of Suzuki et al. do not have proximal and terminal end portions (see Col. 27, line 58 - Col. 28, line 1, and Col. 28, lines 39-43).

It should be pointed out that the Examiner must read prior art references without the hindsight gained from the instant disclosure. When read this way, the combined apparatus of Matsumoto et al. and Suzuki et al. cannot simultaneously include both a plurality of substantially ring-shaped antenna waveguides and the antenna waveguides having proximal and terminal end portions, because the plurality of substantially ring-shaped antenna waveguides are elements in the antenna of Suzuki et al. while the proximal and terminal end portions are elements in the antenna of Matsumoto et al., and these elements are mutually exclusive, as disclosed. Furthermore, the combination of these references fails to teach any connecting waveguide connected to the proximal end portion of each of the antenna waveguides. Thus, the first criterion for a proper *prima facie* case of obviousness has not been met.

As to the second criterion, there is no suggestion or motivation in the aforementioned references to combine or modify the teachings of the references. While the Examiner asserts that the combination would allow microwaves to radiate over a

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1300 I Street, NW
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large area and for a relatively uniform intensity distribution, such alleged motivations are only applicable to Suzuki et al. That is, while the problem addressed by Suzuki et al. is to provide a gas supply means for producing a layer of a high density plasma which is uniform, of a large area, and thin, the problem addressed by Matsumoto et al. is to suppress the size of a microwave plasma process apparatus to be installed in a small space even when the size of a reactor is large. Therefore, one of ordinary skill in the art would not have been motivated to combine the teachings of Suzuki et al. for producing a layer of a high density plasma and with the disclosure of Matsumoto et al. to arrive at the claimed invention. Thus, the second criterion for a proper *prima facie* case of obviousness also has not been met.

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Finally, as to the third criterion, not only does the combination of cited prior art references fail to teach or suggest the claimed invention, the combination does not show a reasonable expectation of success, because it is unclear as to how the plurality of annular waveguides (43, 44) of Suzuki et al. could be incorporated into the device of Matsumoto et al. with respect to the connecting waveguide (21). As becomes clear, the connecting waveguide (21) of Matsumoto et al. is connected to the waveguide antenna part (12) of the antenna (11) radially in the same plane. However, the microwave introducing ports (54, 55) of Suzuki et al. are disposed on the upper surface of the antenna. When the purported combination is viewed without the hindsight gained from the instant application, it is clear that the combination would not only be unsuccessful, but likely impossible.

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In addition, the teaching or suggestion to make the claimed combination and the reasonable expectation of success is not found in the cited references. Therefore, the third criterion for a proper *prima facie* case of obviousness also has not been met.

At least for these reasons set forth above, Applicant respectfully submits that a proper *prima facie* case of obviousness has not been established and respectfully request reconsideration and withdrawal of this ground of rejection. Thus, the present claims define non-obvious subject matter over Matsumoto et al. in view of Suzuki et al.

In addition, new independent claim 15 recites a combination of structural components that are patentable over the teachings of the cited prior art. In particular, claim 15 recites a combination including, among other things, an antenna having a plurality of substantially ring-shaped antenna waveguides with a proximal end portion and a terminal end portion, a connecting waveguide connected to each of the antenna waveguides and having a closed terminal end portion and a plurality of side apertures for supplying the microwaves to each of the antenna waveguides. None of the cited prior art references, taken alone or in combination, teaches or suggest, among other things, a connecting waveguide having a closed terminal end portion and a plurality of side apertures for supplying the microwaves to each of the antenna waveguides. At least for this reason, claims 15-20 are not anticipated or rendered obvious over the cited prior art references.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully submits that the claimed invention is neither anticipated by nor rendered obvious over the prior

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art references cited against this application. Applicant therefore requests reconsideration of this application and the timely allowance of all pending claims.


Attached hereto is a marked-up version of the changes made to the specification and claims 1, 3, 4, 6-8, 10, 11, 13, and 14 by this amendment.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

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By: 
David W. Hill
Reg. No. 28,220

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1300 I Street, NW
Washington, DC 20005
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Fax 202.408.4400
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APPENDIX TO AMENDMENT

IN THE SPECIFICATION:

Paragraph beginning at line 15 of page 6 and ending at line 23 of page 6:

Each of the antenna waveguides 5a and 5b is formed by a rectangular waveguide, the bottom wall (H-plane) of which is formed with a plurality of slots 6a or 6b, and the proximal end (mouth) portions 7a and 7b thereof are connected to the connecting waveguide 4. The connecting waveguide 4 extends to the proximal end portion 7a of the innermost antenna waveguide 5a substantially radially with respect to the antenna waveguides 5a and 5b. The terminal end portion 4a of the connecting waveguide 4 is closed with a microwave absorber 24a.

Paragraph beginning at line 24 of page 6 and ending at line 29 of page 6:

The terminal end portions 8a and 8b of the antenna waveguides 5a and 5b are closed at the side portions of the connecting waveguide 4 with microwave absorbers 28a and 28b, respectively. In the proximal end portions 7a and 7b of the antenna waveguides 5a and 5b, aperture size variable control gates (aperture variable device) 9a and 9b are provided.

Paragraph beginning at line 34 of page 8 and ending at line 4 of page 9:

In this preferred embodiment, while the terminal end portion 4a of the connecting waveguide 4 has been closed with the microwave absorber 24a, the terminal end portion 4a may be closed with a conductor. In such a case, microwaves in the connecting waveguide 4 reflect on the terminal end portion 4a to form standing waves. Therefore, in order to adjust the phase of microwaves in the connecting waveguide 4

with respect to each of the antenna waveguides, the following setting of dimension is carried out.

Paragraph beginning at line 19 of page 9 and ending at line 27 of page 9:

In this preferred embodiment, while the terminal end portions 8a and 8b of the respective antenna waveguides 5a and 5b have been closed with the microwave absorbers 28a and 28b, the terminal end portions 8a and 8b may be closed with conductors. In such a case, microwaves in the respective antenna waveguides 5a and 5b reflect on the terminal end portions 8a and 8b to form standing waves, respectively. Therefore, the length of each of the antenna waveguides 5a and 5b is set to be $[n(\lambda/2) + \lambda/4]$ to adjust the phase of microwaves.

Paragraph beginning at line 1 of page 10 and ending at line 8 of page 10:

Also in this preferred embodiment, the terminal end portions 8a and 8b of the respective antenna waveguides 5a and 5b may be closed with the microwave absorbers 28a and 28b or the conductors. In the case of the conductors, microwaves in the respective antenna waveguides 5a and 5b reflect on the terminal end portions 8a and 8b to form standing waves, respectively. Therefore, the length of each of the antenna waveguides 5a and 5b is set to be $[n(\lambda/2) + \lambda/4]$ to adjust the phase of microwaves.

IN THE CLAIMS:

1. (Amended) A microwave plasma processing system comprising:

a processing vessel;

an antenna for introducing microwaves into said processing vessel, having a plurality of substantially ring-shaped antenna waveguides which are substantially concentrically arranged, each of said antenna waveguides comprising a proximal end

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portion, a terminal end portion, and a rectangular waveguide having a wall in which a plurality of slots are formed at intervals;

a microwave supply source for supplying said microwaves to said antenna; and
a connecting waveguide for connecting said microwave supply source to said proximal end portion of each of said antenna waveguides,

wherein a plasma is produced in said processing vessel by said microwaves introduced from said antenna[,

said antenna having a plurality of substantially ring shaped antenna waveguides which are substantially concentrically arranged,

each of said antenna waveguides comprising a rectangular waveguide having a wall in which a plurality of slots are formed at intervals, a proximal end portion of each of said antenna waveguides being connected to said connecting waveguide].

3. (Amended) A microwave plasma processing system as set forth in claim 1, wherein [a] said terminal end portion of each of said antenna waveguides of said antenna is closed with a conductor.

4. (Amended) A microwave plasma processing system as set forth in claim 1, wherein [a] said terminal end portion of each of said antenna waveguides of said antenna is closed with a microwave absorber.

6. (Amended) A microwave plasma processing system as set forth in claim 1, wherein [a] said terminal end portion of said connecting waveguide is closed with a conductor.

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7. (Amended) A microwave plasma processing system as set forth in claim 1, wherein [a] said terminal end portion of said connecting waveguide is closed with a microwave absorber.
8. (Amended) A microwave plasma processing system comprising:
- a processing vessel having a microwave transmittable top wall;
 - an antenna for introducing microwaves into said processing vessel, mounted on said top wall of said processing vessel and having a plurality of substantially ring-shaped antenna waveguides which are substantially concentrically arranged, each of said antenna waveguides comprising a proximal end portion, a terminal end portion, and a rectangular waveguide having a bottom wall in which a plurality of slots are formed at intervals;
 - a microwave supply source for supplying said microwaves to said antenna; and
 - a connecting waveguide for connecting said microwave supply source to said proximal end portion of each of said antenna waveguides,
- wherein a plasma is produced in said processing vessel by said microwaves introduced from said antenna[, said antenna having a plurality of substantially ring shaped antenna waveguides which are substantially concentrically arranged,
- each of said antenna waveguides comprising a rectangular waveguide having a bottom wall in which a plurality of slots are formed at intervals, the proximal end portion of each of said antenna waveguides being connected to said connecting waveguide].

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10. (Amended) A microwave plasma processing system as set forth in claim 8, wherein [a] said terminal end portion of each of said antenna waveguides of said antenna is closed with a conductor.

11. (Amended) A microwave plasma processing system as set forth in claim 8, wherein [a] said terminal end portion of each of said antenna waveguides of said antenna is closed with a microwave absorber.

13. (Amended) A microwave plasma processing system as set forth in claim 12, wherein [a] said terminal end portion of said connecting waveguide is closed with a conductor.

14. (Amended) A microwave plasma processing system as set forth in claim 12, wherein [a] said terminal end portion of said connecting waveguide is closed with a microwave absorber.

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